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Defining and Assessing Surge Capacities at a Local Public Health Laboratory – An Inductive Model

The Good, The Bad and The Unpredictable – Examples from the Edge

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INTRODUCTION

The City of Milwaukee Health Department Laboratory's (MHDL) surge patterns and practices serve to illustrate management of critical control points and lessons learned that affect surge capacities. Three points covered in this report include:

i) the three paradigms of surge capacities seen at MHDL for which laboratory incidents may fall within: Epidemic, Seasonal, and Incident,
ii) a review of critical control points for each paradigm, and
iii) suggested reasons laboratories may cross a threshold defined as "beyond capacity".

Examples are given of problems encountered, solved and lessons learned. An inductive model to explain lab capacity at MHDL is proposed based on examples and observations during surge situations.

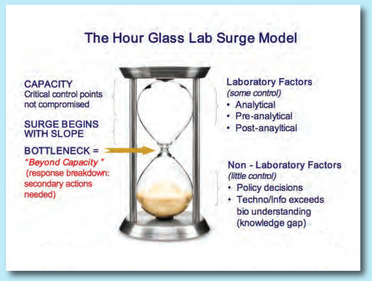
LRN laboratories are continuously confronted with surge situations whether emerging/re-emerging infections or intentional biological, chemical or radiological threat situations. Studying approaches and lessons learned in dealing with such situations from other PHLs can be instructive both in proactive planning and in avoiding pitfalls encountered by PHLs especially as resources diminish during an economic downturn.

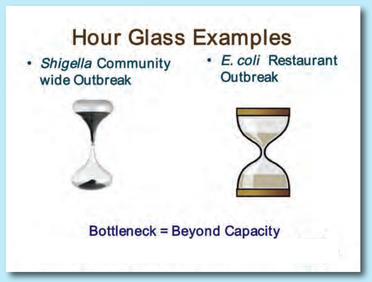
Premise:

- Past a certain threshold a surge is "beyond capacity".
- A "Critical Control Point" (CCP)[1] is "a point or step at which control can be applied and hazard can be prevented, eliminated or reduced to an acceptable level".
- If CCPs are "out of control" capacity may be exceeded.
- 5 CCPs that impact a laboratory's ability to stay within capacity are: Staffing, Workload, Supplies, Communications, Timeload*

*Timeload = significant time expenditures not accounted for in other CCPs (*e.g.,* Administrative & unanticipated operational activities)

The Hour Glass is a graphic representation of this laboratory surge.





The Slippery Slope
The angle (acceleration) and length (time) of the "slippery slope" reflect the acute or chronic nature of the surge, *e.g.,* acute surge: large numbers of food samples submitted from a restaurant; chronic surge: smoldering long term community- wide shigellosis.

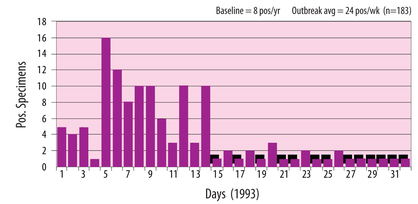
[1] Federal Register 7-25-96, CFR Part 304, Pathogens reduction; Hazard Analysis and Critical Control Point (HACCP) Systems, Final Rule. 38805-38989

3 SURGE PARADIGMS

EPIDEMIC SURGE

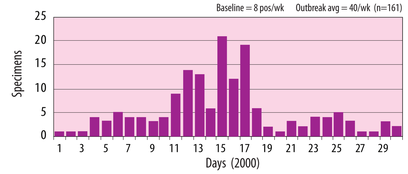
Cryptosporidium Outbreak

4/8/93 – 6/11/93 (8 wks) SSI = 20*



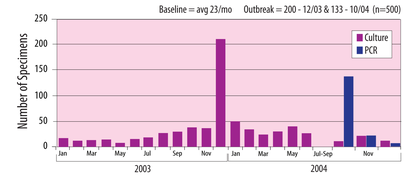
E. coli 0157:H7 Outbreak

Total Stool Cultures & Reference Isolates 7/12/00–8/12/00 (7 wks) SSI = 15*



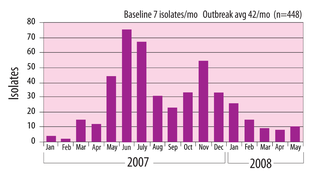
Pertussis Outbreak

12/03–11/04 (11 mo) SSI = 14*



Shigella sonnei Outbreak

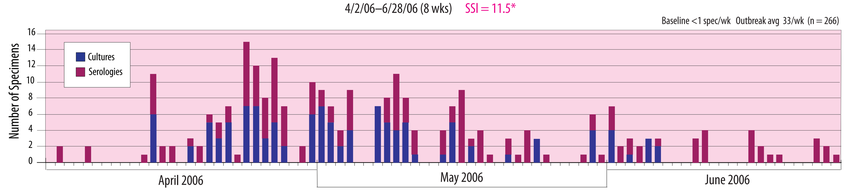
3/07–15/08 (14 mo) SSI = 15.5*



SSI = Subjective Severity Index
*Beyond capacity

Mumps Outbreak

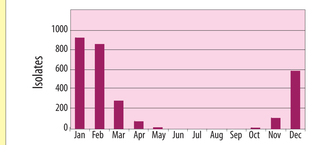
4/2/06–6/28/06 (8 wks) SSI = 11.5*



SEASONAL SURGE

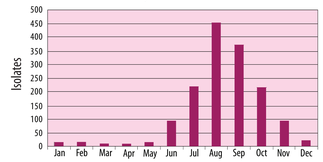
Seasonal Influenza 1967-2008

Isolates/yr = 50–150 SSI = 5



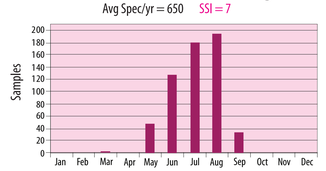
Seasonal Enterovirus 1988-2008

Isolates/yr = 70 SSI = 5



2006 Seasonal Water Testing

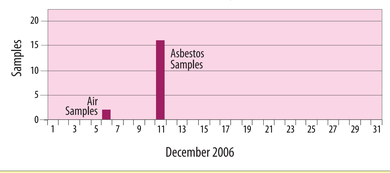
Avg Spec/yr = 650 SSI = 7



INCIDENT SURGE

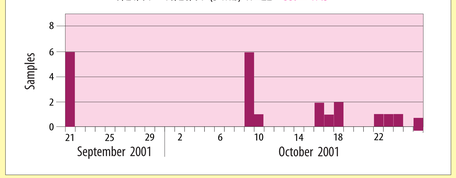
Falk Explosion Incident

12/6/06 – 12/11/06 (6 days) SSI = 6.5



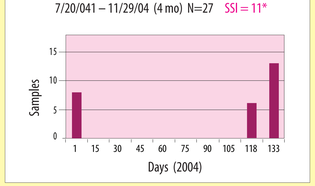
Anthrax Hoax Incident

9/21/01 – 10/26/01 (5 wks) N=22 SSI = 17.5*



Lead-in-Candy Incident

7/20/041 – 11/29/04 (4 mo) N=27 SSI = 11*



Surge-Subjective Severity Index (SSI)

Index indicates pressure on lab operations leading to "beyond capacity or systems breakdown" Most Severe = 4+ Least Severe = 1+

Surges / Critical Control Points	Cryptosporidium 1993	E. coli 0157:H7 2000	Pertussis 2003-2004	Mumps 2006	Shigella 2007-2008	Seasonal Influenza	Seasonal Enterovirus	Seasonal Water Feces	Anthrax Hoaxes 2001	Falk Explosion 2006	Lead-In-Candy 2004
Staffing	4	3	3	2	3.5	1	1	2	3.5	1	1.5
Workload	4	3	2.5	2	3	1	1	2	4	1	1.5
Supplies	4	3	3	2	3	1	1	1	2	1	2
Communications	4	3	2.5	3	3	1	1	1	4	1	3
Timeload	4	3	3	2.5	3	1	1	1	4	2.5	3
Index Score	20	15	14	11.5	15.5	5	5	7	17.5	6.5	11
Beyond Capacity	Yes	Yes	Yes	Yes*	Yes	No	No	No	Yes	No	Yes*
Type of Surge	Epidemic Surge Outbreaks					Seasonal Surges			Incident Surges		
											* disrupted one lab section
Additional Information											
Duration	8W	7W	11M	8W	14M	6M	6M	5M	5W	6D	4M
Workload #	183	161	600	266	448	100	700	650	15	18	27
Workload Type	P	P	S	S	I	I	I	S	S	S	S

W = Weeks M = Months D = Days P = Positive I = Isolates S = Specimens

LESSONS LEARNED

"The Good"

- Good Staff – the ultimate resource
- Messaging, faxback surveys, PHeLAB Network
- Staffing: cross-training, temp services, interns
- Workload: automate, abbrev. workups, batch, outsource
- Technology upgrades (PCR)
- Supplies: more disposables; strategic in-house media
- MOUs (*e.g.,* state & local: the C.A.P., the Coop Agreement)
- ICS, media alerts, political will (programmatic)
- Seasonal flu planning :: pandemic/avian flu planning
- Falk incident work :: chemical terror planning
- Seasonal surge preparation = lessons for other surges
- Risk assessed threat samples

"The Bad"

- Stress (seek E.A.P. advice)
- Delays: PCR testing, MOUs, new method development, cross training
- Retirements/unfilled vacancies
- Be proactive: meet with epi-staff regularly
- Improve communications with line staff, epi, PHNs: test interpretation, collection/transport, verbal or in-person, TAT, complaints
- Supply inventories: kits, media, etc.

"The Unpredictable"

- Length/intensity of outbreaks
- Communications: cell phones, reporting, lab sampling
- Admin.: Legal issues, ICS; more epi staff = more lab tests
- Regulatory issues (esp. food and water): new test validation
- Retirements
- Unreliable tests
- Future large outbreaks r/o intentional
- Willingness/ability to rapidly/sensitively screen large & new populations *e.g.,* highly immunized adolescents

"The Unknown"

- The Knowledge Gap: Technology>Biology
- Mumps outbreak a wakeup call
- "Only a small proportion of cases could be confirmed with the use of viral isolation, PCR analysis and classic serological methods at the CDC"

CONCLUSION

Communicate – Plan Ahead – Be Creative

Reference: Dayan, *et al.* NEJM 4/10/08

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